

## PATENT COOPERATION TREATY

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**INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY**  
 (Chapter II of the Patent Cooperation Treaty)

## (PCT Article 36 and Rule 70)

Applicant's or agent's file reference INT1112WMC	<b>FOR FURTHER ACTION</b>	
See Form PCT/IPEA/416		
International application No. PCT/ZA2004/000008	International filing date (day/month/year) 23.01.2004	Priority date (day/month/year) 24.01.2003
International Patent Classification (IPC) or national classification and IPC B29C41/06, B29C33/06		
Applicant ALMAR PACKAGING SOLUTIONS (PTY) LIMITED et al.		
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> (<i>sent to the applicant and to the International Bureau</i>) a total of 4 sheets, as follows:</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</li> <li><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</li> </ul> <p>b. <input type="checkbox"/> (<i>sent to the International Bureau only</i>) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>		
<p>4. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Box No. I Basis of the opinion</li> <li><input type="checkbox"/> Box No. II Priority</li> <li><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li><input type="checkbox"/> Box No. IV Lack of unity of invention</li> <li><input checked="" type="checkbox"/> Box No. V Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li><input type="checkbox"/> Box No. VI Certain documents cited</li> <li><input type="checkbox"/> Box No. VII Certain defects in the international application</li> <li><input type="checkbox"/> Box No. VIII Certain observations on the international application</li> </ul>		
Date of submission of the demand  24.08.2004	Date of completion of this report  05.11.2004	
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Kujat, C Telephone No. +49 89 2399-2360	
		

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/ZA2004/000008

**Box No. I Basis of the report**

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
  - This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
    - international search (under Rules 12.3 and 23.1(b))
    - publication of the international application (under Rule 12.4)
    - international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

**Description, Pages**

1-12 as originally filed

**Claims, Numbers**

1-17 filed with the demand

**Drawings, Sheets**

1/4-4/4 as originally filed

- a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3.  The amendments have resulted in the cancellation of:
    - the description, pages
    - the claims, Nos.
    - the drawings, sheets/figs
    - the sequence listing (*specify*):
    - any table(s) related to sequence listing (*specify*):
  4.  This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
    - the description, pages
    - the claims, Nos.
    - the drawings, sheets/figs
    - the sequence listing (*specify*):
    - any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims	1-17
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-17
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-17
	No:	Claims	

**2. Citations and explanations (Rule 70.7):**

**see separate sheet**

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**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

Reference is made to the following documents:

- D1: US-A-4 292 015 (HRITZ MICHAEL) 29 September 1981 (1981-09-29)  
D2: US-A-4 690 626 (KRZEPINSKI HORST) 1 September 1987 (1987-09-01)

- 1.1 Document D1, which is considered to represent the most relevant state of the art, discloses (reference is made to figures 8 and 9) a rotational moulding machine according to the preamble of claim 1.
- 1.2 The subject-matter of claim 1 differs from this known rotational moulding machine in that a vertically movable heating station housing and a vertically movable cooling station enclosure are provided, and in that means for simultaneously raising the heating station housing and the cooling station enclosure as specified in claim 1 are provided.
- 1.3 The subject-matter of **claim 1** is therefore new (Article 33(2) PCT).
- 1.4 The problem to be solved by the present invention may be regarded as decreasing the moulding cycle time.
- 1.5 The solution to this problem proposed in **claim 1 of the present application is considered as involving an inventive step** (Article 33(3) PCT) for the following reasons:
  - 1.5.1 While the moulds disclosed in document **D1** are maintained in a casing (reference numeral 30 in figure 2) which includes a gas burner (reference numeral 107 in figure 2), the crane (reference numeral 146 in figures 8 and 9) is only used for removing the moulds from the manipulators. Thereafter, the moulds are cooled by quenching in a liquid bath remote from the carousel (lines 34 to 39 in column 6 of D1).
  - 1.5.2 With regard to a vertically movable heating station housing, document **D2** (reference is made to figures 2 and 4) discloses an open bottom heating

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chamber (reference numerals 4 and 40 in figure 4), which is horizontally movable relatively to a plurality of aligned fixed cooling chambers (reference numerals 2 in figure 2).

- 1.5.3 Since none of the cited prior art documents discloses a vertically movable cooling station enclosure, the exercise of inventive skill is required in order to arrive at the rotational moulding machine according to claim 1. In particular, the provision of means for simultaneously raising the heating station housing and the cooling station enclosure significantly decreases the moulding cycle time.
2. **Claims 2 to 17** are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.
- 3.1 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the **relevant background art** disclosed in the documents D1 and D2 is not mentioned in the description, nor are these documents identified therein.
- 3.2 The features of the claims are not provided with **reference signs** placed in parentheses (Rule 6.2(b) PCT).

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CLAIMS

## 1. A rotational moulding machine comprising

a carousel base which is horizontally rotatable on a floor about a central vertical axis,  
at least three mould manipulators which are mounted on the carousel base to be centred at equal intervals on a circle which is concentric with the axis of rotation of the carousel base,

characterised in that:

the machine includes a vertically movable heating station housing, having an open underside, for enclosing a mould manipulator on the carousel base and means in the housing for heating the mould manipulator and the or each mould which it carries,

a vertically movable cooling station enclosure which includes at least a side wall for surrounding a mould manipulator on the carousel base and means on the enclosure wall for cooling the mould manipulator and the or each heated mould which it carries,

and means, independent from the carousel base, for simultaneously raising the heating station housing and the cooling station enclosure from the carousel base, and the mould manipulators which they enclose, in use, to an elevated position in which they are clear of the mould manipulators to enable the mould manipulators to be moved by indexed rotation of the carousel base from the heating and cooling stations and then simultaneously lowering the heating station housing and the cooling station enclosure over manipulators on the carousel base which have replaced them.

2. A rotational moulding machine as claimed in claim 1 wherein the underside of the carousel base includes a circular track which is fixed to it to be centred on its axis of rotation and the machine includes a set of wheel arrangements which are mounted at suitably spaced intervals on the floor in a circle beneath the carousel base with their wheels engaged with the carousel base track and means for index rotating the carousel base and the mould manipulators which it carries between static mould heating, cooling and mould loading and stripping station positions over the carousel base.
3. A rotational moulding machine as claimed in either one of claims 1 or 2 wherein the heating station housing includes a wall portion for surrounding a mould manipulator on the carousel base and a roof portion with the two housing portions defining between

them a heating chamber which, when the housing is lowered onto the carousel base, totally encloses the mould manipulator.

4. A rotational moulding machine as claimed in claim 3 wherein the heating station housing roof portion is domed to minimise heating space in the chamber.
5. A rotational moulding machine as claimed in either one of claims 3 or 4 wherein the heating means in the heating station housing is at least one gas burner which is fixed to the housing wall.
6. A rotational moulding machine as claimed in any one of the above claims wherein the cooling station enclosure cooling means is at least one air cooling fan.
7. A rotational moulding machine as claimed in claim 6 wherein the cooling station cooling means includes at least one water cooling water spray nozzle.
8. A rotational moulding machine as claimed in any one of the above claims wherein each mould manipulator comprises a frame arrangement which is fixed to the upper surface of the carousel base and includes two spaced upwardly projecting supports, a rectangular frame element which carries stub axles which are attached centrally to and project outwardly from two opposite sides of the frame element with each stub axle being journaled for rotation in one of the frame supports for rotation of the frame element about an axis A, means for supporting at least one mould in the frame element including outwardly projecting shaft portions which are journaled for rotation in the remaining opposite sides of the frame element for rotation of the mould support about a second axis B, which is normal to the axis A, a first bevelled gear ring which is fixed to one of the frame element supports to be concentric with the frame element axis A, a second bevelled gear ring which is meshed with the first, and means releasably locking the second gear ring to a mould support shaft portion so that the gear rings may be uncoupled from and re-engaged with each other.
9. A rotational moulding machine as claimed in claim 8 wherein the frame arrangement of each of the mould manipulators is mounted on a sheet metal base member which is fixed to the upper surface of the carousel base and includes on its upper surface a suitable heat insulating material and a circular upwardly open peripheral channel in which the bottom of at least the sidewall of the heating station housing is sealingly located when the housing has been lowered onto the carousel base over a mould manipulator.

10. A rotational moulding machine as claimed in either one of claims 8 or 9 wherein the diameter of the second gear ring is smaller than the first and the teeth on the two gears are uneven in number so that they are not integer-multiples of one another.
11. A rotational moulding machine as claimed in any one of claims 8 to 10 wherein a drive wheel is fixed to one of the frame element stub axles on the outside of the frame element of each of the mould manipulators for rotating the frame element about its axis A.
12. A rotational moulding machine as claimed in any one of the above claims wherein the carousel base carries three mould manipulators and the heating station housing and the cooling station enclosure are coupled together by a frame structure to which the raising and lowering means is connected.
13. A rotational moulding machine as claimed in any one of claims 1 to 11 wherein the carousel base carries at least five mould manipulators and the machine includes a pair of heating station housings, a pair of cooling station enclosures and at least one mould loading and stripping station with each pair of housings and enclosures being positioned over the carousel base to enclose adjacent mould manipulators on the carousel base when lowered onto the base with the housing and enclosure pairs each being coupled together by a frame structure with the lifting and raising means being adapted to simultaneously raise and lower both frame structures from and onto the carousel base.
14. A rotational moulding machine as claimed in any one of claims 9 to 13 wherein the frame arrangements of the mould manipulators are so fixed to the carousel base that their frame element axes A intersect each other on the axis of rotation of the carousel base with the mould manipulator frame element stub axles which carry the drive wheels being radially innermost on the axes A of the frame elements.
15. A rotational moulding machine as claimed in claim 14 wherein the or each heating station housing and cooling station enclosure carries a vertical slot in its side wall which is open to the underside of the wall for the passage in it of a mould manipulator drive wheel stub axle so that the drive wheel is situated on the outside of the or each heating station housing and cooling station enclosure when the or each housing and enclosure is lowered onto the carousel base.

16. A rotational moulding machine as claimed in claim 15 wherein each frame structure which couples a pair of mould manipulator enclosures carries two mould manipulator drive arrangements which are so located in the frame structure that each will engage a drive wheel of a mould manipulator to drive the manipulator only when the enclosure is lowered onto the carousel base over the manipulator and to disengage from the drive wheel when the frame structure which carries them is raised from the carousel base.
17. A rotational moulding machine as claimed in any one of claims 12 to 16 wherein the raising and lowering means for the or each frame structure is a fixed overhead crane beam which is located over the centres of the mould manipulator enclosures which are carried by the frame structure and ropes which depend from the beam and are attached to the frame structure for raising it from and lowering it onto the carousel base.